PATENT SPECIFICATION

DRAWINGS ATTACHED

840,850

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COMPLETE SPECIFICATION

Improvements relating to High Frequency Aerial-arrangements

We, TELEFUNKEN G.M.B.H., a Company organised under the laws of Germany, of Sickingenstrasse 71, Berlin NW.87, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to high frequency aerial arrangements.

When employing a high frequency conductor as a radiating limb of an aerial arrangement, the dimensions of the conductor should be determined not only having regard to required electrical properties but with regard also to mechanical strength or rigidity of the arrangement. For example, unsupported conductors must be designed to withstand wind pressures and loading with ice. With some dipole aerial arrangements, however, difficulty is experienced in reconciling the required mechanical and electrical properties.

The object of the present invention is to provide an aerial arrangement which permits greater flexibility in the choice of mechanical and electrical properties.

According to the present invention there is provided a dipole aerial arrangement comprising two radiator limbs and a coaxial feeder which extends longitudinally through one of said limbs to the adjacent ends of said limbs, the outer conductor of said feeder being connected to said one limb and the inner conductor of said feeder being connected to the other limb at said ends, and said one limb comprising a plurality of spirally wound conductors encased in an insulating tubular body within which the feeder is located so that said one limb forms, in conjunction with said outer feeder conductor, a wavetrap in which the effective diameter of said limb is substantially greater than the actual diameter.

It will be appreciated that the wavetrap formed in accordance with the invention by one of the aerial limbs and by the outer conductor of the feeder which extends through that limb, corresponds to a $\lambda/4$ length of transmission line short circuited at the end of the aerial limb adjacent to the other aerial limb, so that a high impedance is presented at the other end of the line to a band of frequencies around that corresponding to wavelength λ and this band of frequencies can be made wider by arranging that the impedance of the trap is very high. By virtue of the invention, it is not necessary to make the limb incorporating the wavetrap of especially large diameter to obtain the desired high impedance for the impedance is increased by the fact that the limb which carries the feeder comprises a plurality of thin individual conductors.

Preferably the other aerial limb also comprises a plurality of spirally wound conductors. In both limbs the individual conductors can be of selected cross-section, for example circular or ribbon-shaped cross-section and by varying the number and the width of the individual conductors the impedance of an aerial arrangement according to the invention can be varied within wide limits. Another feature is that owing to the mechanical properties of available insulating materials, substantial mechanical strength can also be achieved.

The individual conductors encased within the wall of the tubular body of each aerial limb can, if a reduction of the length of the member is desired, be of coiled spiral form or of any other suitable configuration. The tubular body supporting the individual conductors need not furthermore be of circular cylindrical shape. A cylinder on virtually any shaped body can be used, or the body may be conical or barrel-shaped, if such a shape fulfils the electrical requirements.

To vary the impedance of the aerial for a given frequency use can, as will be appre-

ciated hereafter, be made of an annular conductor such as a metal ring slideable on or within the insulating tubular body.

In order to supplement the strength of an aerial according to the invention and to arrange the individual conductors before they are set within the plastic material, non-conductive fibrous materials, preferably spun or drawn threads, can also be embedded in the insulating body. If the non-conductive threads or fibres are placed virtually parallel to the general direction of the conductors, they can be moulded with them to form the tubular body. For instance, a prepared bunch of non-conductive threads and conductors may be wound around a spindle and be saturated with a liquid form of self-hardening plastic. Alternatively, conductors and non-conductive threads may be spliced together to form a woven hose. If it is desirable to achieve an especially high attenuation or to reduce the length of the aerial limbs as compared with the effective electrical length, it is desirable to wind the conductor as tight coiled spirals around one or more non-conductive threads. These threads can then be moulded together into a tube in the manner described or can be spliced to form a woven hose.

After the combination of conductive and non-conductive threads have been saturated with self setting resin and the latter has set, the spindle upon which the hose is wound is withdrawn.

Glass fibres are especially suitable for embedding alongside the individual conductors in the wall of the tubular body or, in the event of higher strength requirements, synthetic fibres of known kind may be used. If the fibrous material and the plastic used are sufficiently transparent, an additional advantage is obtained in that an aerial according to the invention viewed against the sky is substantially less noticeable than may otherwise be so.

In order that the invention may be clearly understood and readily carried into effect, the invention will be described with reference to the accompanying drawings, in which:—

Fig. 1 illustrates a dipole aerial arrangement according to one example of the present invention.

Fig. 2 illustrates an electrical equivalent of the dipole aerial shown in Fig. 1; and

Fig. 3 illustrates an alternative mode of construction of a radiating limb for a dipole aerial arrangement according to the invention.

The aerial-arrangement of Fig. 1 consists of a vertical dipole aerial, and the lower aerial limb functions also as a wavetrap. In Fig. 2 the arrangement of Fig. 1 is represented in an electrically equivalent form in order to make it readily understood. Thus, an upper aerial limb of length $\lambda/4$, is connected to the inner conductor of the coaxial feeder 10, whilst a lower aerial part of length $\lambda/4$ is connected to the outer conductor of the same feeder. An arrangement equivalent to Fig. 1. constructed of coaxial cable of conventional form, would have relative dimensions such as represented in Fig. 2, which shows that the wavetrap formed by the lower aerial limb and the outer conductor of the feeder 10 would be of substantially greater diameter than the upper aerial limb. However by the arrangement shown in Fig. 1, the difference between the diameters of the upper and lower aerial-limbs is avoided. In the aerial shown in Fig. 1 each limb comprises a plurality of spirally wound conductors encased in an insulating tubular body. The tubular insulating body is co-extensive with both limbs and is denoted by the reference 5. It is preferably transparent and conductive rings 6, *6a*, *6b* and *6c* are provided as shown. Between these rings are connected respective individual conductors 7 and *7a* for the respective radiating limbs, which are wound in spirals on non-conductive cores. Thus the upper aerial limb of length $\frac{\lambda}{4}$ is connected at the point 11, at the end adjacent to the lower limb to the inner conductor of the coaxial feeder 10 whilst the lower radiating limb of length $\frac{\lambda}{4}$ is connected at the point 12 at the end adjacent to the upper limb, to the outer conductor of 10. At the lower end of the plastic body in the vicinity of the conductive ring *6c* there is placed a cast iron ring 8, which can be positioned on the lower part of the aerial to provide tuning for the wavetrap formed by the lower limb and the outer conductor of 10. The plastic tube 5 is mounted on a supporting tube 9 in which the feeder 10 is located. The lower limb, comprising the conductors *7a* forms as aforesaid, a wavetrap in conjunction with the outer conductor of the feeder 10 since the length of the limb is $\frac{\lambda}{4}$ and a short circuit is provided at the point 12 and therefore a high impedance is presented between the lower end of the lower limb of the aerial and the outer conductor of 10. It is not necessary to make the diameter of the lower limb of the aerial greater than that of the outer limb to provide the requisite impedance.

Referring to Figs. *3a* and *3b*, reference 1 denotes a plastic body in the base of which is set a conductive ring 2. Extending from the ring 2 like the spokes of a wheel are conductors 3 which are embedded in the base of the plastic body. The conductors 3 are

connected to the conductors 4 which are of spiral form and are embedded in the cylindrical portion of the plastic body.

By employing an arrangement such as shown in Figs. 3 and 3*a* to form the radiating limbs in a dipole aerial arrangement such as shown in Fig. 1, the physical length of the limbs may be substantially reduced relative to their effective electrical length.

It will be appreciated that an aerial in accordance with the invention is protected against disturbing influences of the weather.

WHAT WE CLAIM IS:—

1. A dipole aerial arrangement comprising two radiator limbs and a coaxial feeder which extends longitudinally through one of said limbs to the adjacent ends of said limbs, the outer conductor of said feeder being connected to said one limb and the inner conductor of said feeder being connected to the other limb at said ends, and said one limb comprising a plurality of spirally wound conductors encased in an insulating tubular body within which the feeder is located, so that said one limb forms, in conjunction with said outer feeder conductor, a wavetrap in which the effective diameter of said limb is substantially greater than the actual diameter.

2. An aerial arrangement according to Claim 1 wherein an annular conductor is movable on or within the insulating tubular body.

3. A dipole aerial arrangement according to Claim 1 or 2, wherein said other limb comprises a plurality of spirally wound conductors encased in an insulating tubular body.

4. An aerial arrangement according to Claim 1, 2 or 3, wherein said conductors are wound spirally about an axis common to different ones of said conductors.

5. An aerial arrangement according to Claim 1, 2, 3 or 4 wherein said conductors are wound spirally about axes individual to the different conductors.

6. An aerial arrangement according to any of Claims 1 to 5, wherein the material of the or each insulating tubular body is a synthetic plastic.

7. An aerial arrangement according to any of Claims 1 to 6 wherein the individual conductors extend substantially along generating lines of the respective insulating tubular body.

8. An aerial arrangement according to any of Claims 1 to 7, wherein the or each insulating tubular body is conical or barrel-shaped.

9. An aerial arrangement according to any of Claims 1 to 8, wherein non-conductive fibrous substances, preferably spun or drawn threads are embedded, in addition to the conductors, in the wall of the or each insulating tubular body.

10. An aerial arrangement according to Claim 9 wherein said non-conductive threads or fibres are spliced with said conductors.

11. An aerial arrangement according to Claim 9 wherein the non-conductive threads or fibres are woven with said conductors to form a woven hose.

12. An aerial arrangement according to any of Claims 1 to 8 wherein said conductors are wound spirally around one or more non-conductive strands or fibres.

13. An aerial arrangement substantially as described herein with reference to the accompanying drawings.

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840850 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

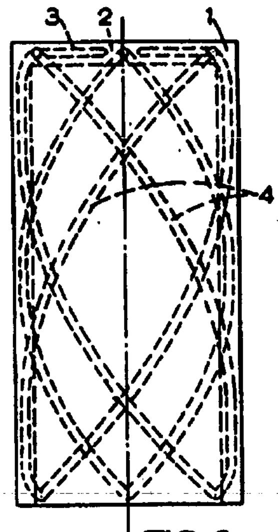

FIG. 3a.

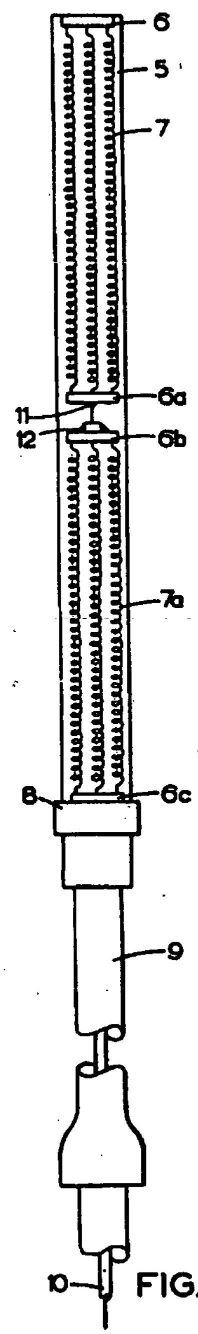

FIG. 1.

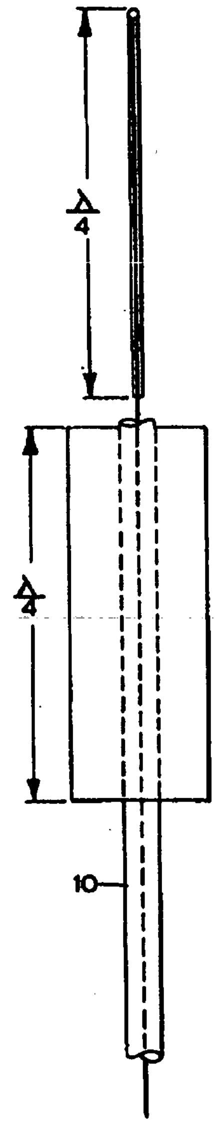

FIG. 2.

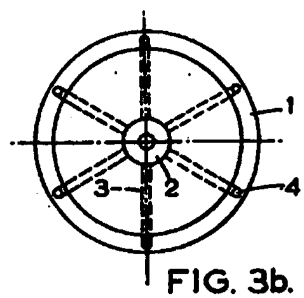

FIG. 3b.